![תמונה שמכילה גופן, טקסט, לוגו, גרפיקה

התיאור נוצר באופן אוטומטי]()

Software Engineering Department  
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**Capstone Project Phase A – 61998**

**TravelWithUs app**

**24-1-D-32**

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**Git:** [**https://github.com/Peleg2719/FinalProject**](https://github.com/Peleg2719/FinalProject)

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**Abstract**

**TravelWithUsApp** is an innovative desktop application designed to revolutionize the way travelers learn and practice foreign languages. The app focuses on equipping users with essential language skills to handle various situations during their travels abroad, utilizing advanced voice recognition technology. Through **TravelWithUsApp**, users are provided with an immersive and interactive learning experience, where they engage in real-time dialogues, receive immediate feedback, and improve their language proficiency in a gamified environment.

The application is built around the principles of contextual learning and immediate feedback, which are scientifically proven to enhance the language acquisition process. Rather than learning isolated words and phrases, users experience real-life scenarios and practice the language within its full context, such as interacting with locals, asking for help, or dealing with emergencies. The advanced voice recognition technology enables users to practice speaking in the foreign language and receive immediate correction of their errors, improving their accuracy and fluency over time.

**TravelWithUsApp** is specifically designed for travelers who wish to deepen their language skills before their journey or during their trip. The app features lessons that are graded by difficulty levels, making it suitable for both beginners and advanced learners. Additionally, the app allows users to track their progress through a cloud-based database, which provides motivation for continuous improvement. The vision of **TravelWithUsApp** is to empower travelers by giving them the confidence and tools necessary to navigate foreign environments with ease and independence.

**1.Introduction**

Learning a foreign language is a complex and multifaceted process that requires learners to acquire not only vocabulary and grammar but also communicative skills and cultural understanding. Traditional language learning methods often rely heavily on rote memorization and repetitive exercises, which can lead to boredom and low retention rates. **TravelWithUsApp** was developed to address these challenges by combining educational content with interactive gameplay, grounded in the principles of contextual learning and immediate feedback.

The app is designed for travelers who want to improve their language skills in a practical and relevant way, tailored to real-world situations they may encounter during their travels. **TravelWithUsApp** allows users to choose from a variety of common everyday scenarios, such as ordering food in a restaurant, asking for directions, or seeking help in an emergency. During these interactions, the app uses advanced voice recognition technology to detect the user's speech and provide instant feedback, enabling the user to correct their mistakes and improve their language performance.

**TravelWithUsApp** is crafted to offer a personalized learning experience, adapted to each user’s learning pace and style. By leveraging technologies such as Google Cloud Speech-to-Text, the app provides support for a wide range of languages and dialects, delivering a precise and reliable learning experience even in noisy environments. Additionally, **TravelWithUsApp** incorporates elements of gamification, including a point system, achievements, and progress tracking, to increase user engagement and motivation.

The app is built on the Unity platform, which allows for the development of rich, interactive 2D environments specifically for desktop devices. This focus on desktop compatibility ensures that users can access the app from their computers and use it to improve their language skills in an engaging and immersive environment.

Ultimately, **TravelWithUsApp** is designed to transform the language learning process into a fun, enriching, and empowering experience. By utilizing advanced technologies such as voice recognition and immediate feedback, combined with the principles of contextual learning and gamification, **TravelWithUsApp** becomes a unique and powerful tool for language learning, tailored specifically to the needs of travelers in the 21st century.

**2. Development Process**

**Description:**

The development of **TravelWithUsApp** was a complex and multifaceted project aimed at creating an immersive language learning experience for desktop users. The process began with translating our initial conceptual ideas into detailed requirements that could be implemented in code. This involved close collaboration between our design, development, and research teams to ensure that every aspect of the application would contribute to an engaging and educational user experience.

**2.1 Initial Planning and Requirements Gathering**

In the early stages, we focused on identifying the key features and functionalities that would make **TravelWithUsApp** both effective as a language learning tool and enjoyable as an interactive application. We conducted thorough research into existing language learning platforms and identified gaps that our app could fill, particularly in providing real-world, context-based language practice with instant feedback.

Based on this research, we defined the core requirements for the app, including the need for accurate voice recognition, real-time feedback, and a user-friendly interface that could guide users through various travel-related scenarios. We also established that the app would need to be robust enough to handle multiple languages and dialects, ensuring accessibility for a global audience.

**2.2 Technology Selection**

Given the specific needs of **TravelWithUsApp**, we chose the Unity platform for its powerful capabilities in developing rich, interactive 2D environments tailored for desktop platforms. Unity’s extensive support for various plugins and its flexibility in integrating third-party services made it the ideal choice for our project.

For the voice recognition component, we opted for Google Cloud Speech-to-Text, which offers highly accurate and reliable transcription services. This choice was driven by the tool’s ability to handle multiple languages and accents, as well as its seamless integration with Unity.

To manage user data and provide a seamless experience, we selected Google Firebase for our backend infrastructure. Firebase was chosen for its robust real-time database, which allows us to securely store user progress and handle data processing with minimal latency. This setup is essential for delivering instant feedback to users and ensuring a smooth and responsive user experience.

**2.3 Development Phases**

The development of **TravelWithUsApp** was broken down into several key phases, each focused on a specific aspect of the application:

**2.3.1 User Interface (UI) and User Experience (UX) Design:** The first phase involved designing the UI/UX to ensure that the app would be intuitive and easy to navigate. We developed wireframes and prototypes that were tested with potential users to gather feedback on usability. This iterative process allowed us to refine the design before moving into full development.

**2.3.2 Backend Development**: In parallel with the UI/UX design, we, as a small team of two, took on the task of setting up the entire backend infrastructure ourselves. We handled all aspects of backend development, choosing Google Firebase for its simplicity and powerful capabilities. This involved configuring Firebase for real-time data storage and secure user authentication. We implemented REST APIs to ensure secure communication between the app and Firebase, utilizing HTTPS protocols to protect data privacy and integrity. Despite our limited team size, we successfully managed all backend operations, ensuring that the app would provide a seamless and responsive experience for users.

**2.3.3 Voice Recognition Integration:** Integrating Google Cloud Speech-to-Text was a critical phase in the development process. We began by setting up the API within Unity and testing its accuracy with different languages and dialects. A significant challenge we encountered was implementing both Spanish and English languages within the project. This required us to fine-tune the API not only to minimize latency but also to ensure it could accurately distinguish between the two languages during real-time use. Handling simultaneous voice recognition for multiple languages added complexity, as we needed to develop a system capable of identifying which language was being spoken and then correctly processing the input accordingly. Despite these challenges, we successfully integrated a responsive and reliable voice recognition system that provides instant feedback during language practice sessions, enhancing the learning experience for users.

**2.3.4 Scenario Development:** A significant portion of the development was dedicated to creating the interactive scenarios that form the core of the TravelWithUsApp experience. Each scenario was designed to reflect real-world travel situations, such as ordering food in a restaurant or asking for directions. These scenarios were not chosen at random; they were carefully selected based on a survey we conducted, which identified the situations people most wanted to improve in while traveling abroad. The survey results guided us in crafting scenarios that would be most relevant and beneficial to our users. Each scenario was also meticulously designed to include multiple possible dialogues, providing users with a range of responses to practice, ensuring that the app offers a comprehensive and practical language learning experience.

**2.3.5 Testing and Refinement:** Once the core features were developed, the app underwent extensive testing. We conducted unit tests to verify the functionality of individual components, integration tests to ensure that all parts of the system worked together seamlessly, and user acceptance tests to gather feedback from real users. This phase also involved performance testing to ensure that the app could handle real-time processing without lag, even under heavy use.

**2.3.6 Finalization and Deployment:** The final phase involved making necessary adjustments based on the feedback from testing and preparing the app for deployment. This included optimizing the code for performance, ensuring compatibility across different desktop systems, and setting up the necessary infrastructure for user support and maintenance.

**2.4 Challenges and Solutions**

Throughout the development process, we encountered several challenges that required innovative solutions:

* **Handling Diverse Language Inputs:** Ensuring that the voice recognition system could accurately process different accents and dialects was a major challenge. We addressed this by implementing a comprehensive testing phase that included speakers of various backgrounds and fine-tuning the API settings to improve recognition accuracy.
* **Real-Time Feedback Loop:** Providing real-time feedback without any noticeable delay was crucial for the user experience. To achieve this, we optimized the data flow between the client and server, using efficient data processing techniques and reducing the payload size for faster transmission.
* **User Engagement:** Keeping users engaged over extended periods was essential for the success of the app. We incorporated gamification elements, such as a point system and progress tracking, to motivate users to continue practicing their language skills.

**2.5 Tools and Technologies Used**

The development of **TravelWithUsApp** leveraged a variety of tools and technologies:

* **Unity:** For creating the interactive 2D environments and managing the overall application logic.
* **Google Cloud Speech-to-Text:** For voice recognition, providing accurate and responsive transcription services, particularly in supporting both English and Spanish languages.
* **Google Firebase:** For backend infrastructure, including real-time data storage and secure user authentication.
* **Visual Studio:** The primary integrated development environment (IDE) used for coding, development, and debugging.
* **GitHub:** For version control and collaboration, enabling seamless coordination between team members.
* **Postman:** For testing and validating the REST APIs to ensure reliable communication between the app and Firebase.

**2.6 Diagrams**

**2.6.1 System Architecture Diagram**

The System Architecture Diagram illustrates the overall structure of **TravelWithUsApp** and how its components interact with each other. At the core of the system is the client application built on the Unity platform, running on desktop devices. The client communicates with Google Firebase for real-time data storage and user authentication. Key components of the architecture include:

* **Unity Client:** Responsible for the user interface, game logic, and communication with the backend through APIs.
* **Google Firebase:** Provides backend services, including real-time database and user management.
* **Google Cloud Speech-to-Text API:** Integrated within the Unity client to handle voice recognition, providing transcription services in real-time for both English and Spanish languages.

This diagram shows how data flows between these components, ensuring a seamless and responsive user experience.

**2.6.2 Activity Diagram**

The Activity Diagram provides a visual representation of the user interactions within **TravelWithUsApp**. It outlines the steps a user takes from launching the app to completing language practice sessions. The diagram includes the following key activities:

* **User Login:** The user begins by logging in or registering, which is handled through Firebase Authentication.
* **Scenario Selection:** After login, the user selects a travel-related scenario to practice.
* **Voice Interaction:** The user engages in the scenario using voice commands, which are processed by Google Cloud Speech-to-Text.
* **Feedback Loop:** The app provides real-time feedback based on the user's responses, guiding them to improve their language skills.
* **Progress Tracking:** The user's progress is saved in Firebase, allowing them to continue from where they left off in future sessions.

This diagram helps in understanding the flow of actions and decision points that shape the user’s experience in the app.

**2.6.3 Sequence Diagram**

The Sequence Diagram details the interaction between the various components of **TravelWithUsApp** during a typical user session. It shows the sequence of messages exchanged between the client, Google Cloud Speech-to-Text, and Firebase. The steps include:

* **Initiating a Voice Command:** The user speaks a command, which is captured by the Unity client.
* **Processing the Command:** The client sends the audio input to Google Cloud Speech-to-Text, which processes it and returns the transcribed text.
* **Handling the Response:** The client uses the transcribed text to determine the appropriate feedback or action, such as correcting the user's pronunciation or advancing the scenario.
* **Storing Progress:** The client updates the user’s progress in Firebase, ensuring their achievements and improvements are saved.

This diagram illustrates the order of operations and the interactions that ensure smooth functionality within the app.

**2.6.4 Data Flow Diagram (DFD)**

The Data Flow Diagram (DFD) represents the flow of data within **TravelWithUsApp**. It highlights how data moves between the user, the client application, and the backend services. The key data flows include:

* **User Data:** Includes login credentials, progress data, and preferences, which flow between the client and Firebase.
* **Voice Data:** The user's spoken input is transmitted from the client to Google Cloud Speech-to-Text and then the transcribed text flows back to the client.
* **Feedback Data:** Based on the transcribed text and user interactions, feedback data is generated and presented to the user, influencing their learning experience.

This diagram provides an overview of how data is managed, processed, and utilized to deliver a comprehensive and responsive user experience.

**2.7 Voice Recognition and Language Processing**

**Google Cloud Speech-to-Text Integration:**

The integration of Google Cloud Speech-to-Text was a crucial aspect of **TravelWithUsApp**. This API provides the backbone for our app's voice recognition capabilities, allowing users to engage in real-time dialogues while practicing a new language. We began by configuring the API within Unity and conducting extensive testing across different languages and dialects, specifically focusing on English and Spanish. This phase involved fine-tuning the API to ensure high accuracy in transcription, even in diverse and noisy environments.

**Handling Multiple Languages:**

A significant challenge we faced was the simultaneous handling of multiple languages. The system needed to accurately detect which language the user was speaking—English or Spanish—and switch between language models accordingly. This required sophisticated logic within our app to determine the context and expected language, ensuring that the voice recognition system provided the correct feedback in real-time.

**Scenario-Based Language Practice:**

We developed interactive scenarios based on real-world travel situations, such as ordering food in a restaurant or asking for directions. These scenarios are central to the **TravelWithUsApp** experience, offering users a realistic environment to practice their language skills. Each scenario was carefully crafted to include multiple potential dialogues, allowing users to engage in varied conversations. The voice recognition system plays a key role in these scenarios, interpreting user input and providing immediate feedback on pronunciation and word usage.

**Training and Fine-Tuning:**

Although **TravelWithUsApp** does not utilize reinforcement learning like the "Gravity Shooter" game, we focused heavily on training and fine-tuning the voice recognition models. We collected a diverse set of voice samples during development to improve the accuracy of our language models. This process involved iterating on the API settings and feedback mechanisms to ensure that users receive accurate and useful guidance as they navigate through different scenarios.

**Model Usage:**

After fine-tuning, the voice recognition models were integrated into the app’s core functionality. Instead of directly controlling gameplay as in the example, these models provide users with real-time corrections and suggestions based on their spoken input. By comparing the user’s pronunciation with the model’s ideal output, the app offers constructive feedback, helping users to improve their language skills progressively.

**Evaluating User Progress:**

To ensure the effectiveness of our language learning tool, we implemented features to track and evaluate user progress. This includes metrics like pronunciation accuracy, response time, and the complexity of language used in each scenario. These metrics are stored in Firebase, allowing users to review their progress over time and continue improving their skills in subsequent sessions.